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JUL 16 2007

Appl. No. 10/677,966
Docket No. 14XZ126398/GEM-0171

AAMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions and listings of claims in the application.

Listing of Claims:

1. (previously presented) A method for a space-time filtering of noise in radiography comprising:
 - a. for each pixel having coordinates (x,y) of a first image, a weighting is performed on coefficients $U(k,l)$ of a first convolution core with a dimension D , equivalent to a low-pass filter, as a function of a coefficient G which is a function of a difference computed between $I(x,y)$ and $I(x+k, y+l)$, where $I(x,y)$ is an intensity of the pixel with coordinates (x,y) of the first image, and k and l are indices used to explore the coefficients of the first convolution core, a second convolution core with coefficients $U_p(k,l)$ being thus obtained;
 - b. for each pixel with coordinates (x,y) of the first image, a weighting is performed on the coefficients $U(k,l)$ of the first convolution core as a function of the coefficient G which is a function of the difference computed between $I(x,y)$ and $I'(x+k, y+l)$, where $I'(x,y)$ is an intensity of the pixel with coordinates (x,y) of a second image, a third convolution core with coefficients $U_p'(k,l)$ being thus obtained; and
 - c. a filtered value of $I(x,y)$ is computed by the formula:

$$F(x, y) = \left(\sum_{k=-L}^L \sum_{l=-L}^L (\gamma * U_p(k, l) I(x+k, y+l) + (1-\gamma) * U_p'(k, l) I'(x+k, y+l)) \right) / N \dots (1)$$

$$L = (D-1)/2 \dots (2)$$

$$\gamma \in [0,1] \dots (3)$$

$$N = \sum_{k=-L}^L \sum_{l=-L}^L (\gamma * U_p(k, l) + (1-\gamma) * U_p'(k, l)) \dots (4)$$

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where $F(x,y)$ is the filtered value of $I(x,y)$; and
wherein D is greater than 1;
wherein a value of γ is greater than 0 and less than 1.

2. (previously presented) The method according to claim 1 wherein:

$$U_p(k,l) = U(k,l) \times G(I(x+k,y+l) - I(x,y); \sigma(I(x,y))); \text{ and}$$

$$U'_p(k,l) = U(k,l) \times G(I(x+k,y+l) - I(x,y); \lambda \sigma(I(x,y)))$$

with G as a weighting function depending on a difference ϵ between the value of the pixel to be filtered and its neighborhood and depending on a noise statistic σ for the value of the pixel to be filtered at a filter strength defined by λ .

3. (previously presented) The method according to claim 2 wherein G is a function of a difference ϵ computed and of a known noise statistic σ for $I(x,y)$, the coefficient G being then written as a function $G(\epsilon, \sigma)$, where G is therefore a value in terms of ϵ of a Gaussian curve centered on 0 and having a standard deviation σ .

4. (previously presented) The method according to claim 2 wherein G is a function of the computed difference ϵ of the following type:

$$G(\epsilon) = -a \cdot \epsilon + 1, \text{ with } a > 0,$$

$$U_p(k,l) = U(k,l) \times G(I(x+k,y+l) - I(x,y)), \text{ and}$$

$$U'_p(k,l) = U(k,l) \times G(I(x+k,y+l) - I(x,y)).$$

5. (original) The method according to claim 2 wherein λ is a real number.
6. (original) The method according to claim 3 wherein λ is a real number.
7. (original) The method according to claim 4 wherein λ is a real number.

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8. (original) The method according to claim 1 wherein equation (1) becomes:

$$F(x, y) = \left(\sum_{k=-L}^L \sum_{l=-L}^L (\gamma * U_p(k, l) \cdot I(x+k, y+l) + (1-\gamma) * U_p'(k, l) \cdot F'(x+k, y+l)) \right) / N$$

where $F'(x, y)$ is the filtered intensity of the pixel with coordinates (x, y) of the second image.

9. (original) The method according to claim 2 wherein equation (1) becomes:

$$F(x, y) = \left(\sum_{k=-L}^L \sum_{l=-L}^L (\gamma * U_p(k, l) \cdot I(x+k, y+l) + (1-\gamma) * U_p'(k, l) \cdot F'(x+k, y+l)) \right) / N$$

where $F'(x, y)$ is the filtered intensity of the pixel with coordinates (x, y) of the second image.

10. (original) The method according to claim 3 wherein equation (1) becomes:

$$F(x, y) = \left(\sum_{k=-L}^L \sum_{l=-L}^L (\gamma * U_p(k, l) \cdot I(x+k, y+l) + (1-\gamma) * U_p'(k, l) \cdot F'(x+k, y+l)) \right) / N$$

where $F'(x, y)$ is the filtered intensity of the pixel with coordinates (x, y) of the second image.

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11. (original) The method according to claim 4 wherein equation (1) becomes:

$$F(x, y) = \left(\sum_{k=-L}^L \sum_{l=-L}^L (\gamma * U_p(k, l) \cdot I(x+k, y+l) + (1-\gamma) * U_p'(k, l) \cdot F'(x+k, y+l)) \right) / N$$

where $F'(x, y)$ is the filtered intensity of the pixel with coordinates (x, y) of the second image.

12. (original) The method according to claim 5 wherein equation (1) becomes:

$$F(x, y) = \left(\sum_{k=-L}^L \sum_{l=-L}^L (\gamma * U_p(k, l) \cdot I(x+k, y+l) + (1-\gamma) * U_p'(k, l) \cdot F'(x+k, y+l)) \right) / N$$

where $F'(x, y)$ is the filtered intensity of the pixel with coordinates (x, y) of the second image.

13-18. (canceled)

19. (previously presented) The method according to claim 1 wherein the first and second images are successive images of a sequence of images, the first image having a time t , and the second image having a time $t-1$.

20. (previously presented) The method according to claim 2 wherein the first and second images are successive images of a sequence of images, the first image having a time t , and the second image having a time $t-1$.

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21. (previously presented) The method according to claim 3 wherein the first and second images are successive images of a sequence of images, the first image having a time t , and the second image having a time $t-1$.

22. (previously presented) The method according to claim 4 wherein the first and second images are successive images of a sequence of images, the first image having a time t , and the second image having a time $t-1$.

23. (previously presented) The method according to claim 5 wherein the first and second images are successive images of a sequence of images, the first image having a time t , and the second image having a time $t-1$.

24. (previously presented) The method according to claim 8 wherein the first and second images are successive images of a sequence of images, the first image having a time t , and the second image having a time $t-1$.

25. (previously presented) The method according to claim 13 wherein the first and second images are successive images of a sequence of images, the first image having a time t , and the second image having a time $t-1$.

26. (original) The method according to claim 1 wherein D is equal to 5.

27. (original) The method according to claim 2 wherein D is equal to 5.

28. (original) The method according to claim 3 wherein D is equal to 5.

29. (original) The method according to claim 4 wherein D is equal to 5.

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30. (original) The method according to claim 5 wherein D is equal to 5.
31. (original) The method according to claim 8 wherein D is equal to 5.
32. (original) The method according to claim 13 wherein D is equal to 5.
33. (original) The method according to claim 19 wherein D is equal to 5.
34. (original) The method according to claim 1 wherein D is greater than 5.
35. (original) The method according to claim 2 wherein D is greater than 5.
36. (original) The method according to claim 3 wherein D is greater than 5.
37. (original) The method according to claim 4 wherein D is greater than 5.
38. (original) The method according to claim 5 wherein D is greater than 5.
39. (previously presented) The method according to claim 8 wherein D is greater than 5.
40. (previously presented) The method according to claim 13 wherein D is greater than 5.
41. (original) The method according to claim 19 wherein D is greater than 5.
42. (cancelled)
43. (original) The method according to claim 1 wherein D is an odd number.

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- 44. (original) The method according to claim 2 wherein D is an odd number.
- 45. (original) The method according to claim 3 wherein D is an odd number.
- 46. (original) The method according to claim 4 wherein D is an odd number.
- 47. (original) The method according to claim 5 wherein D is an odd number.
- 48. (original) The method according to claim 8 wherein D is an odd number.
- 49. (original) The method according to claim 13 wherein D is an odd number.
- 50. (original) The method according to claim 19 wherein D is an odd number.
- 51. (original) The method according to claim 26 wherein D is an odd number.
- 52. (original) The method according to claim 34 wherein D is an odd number.
- 53. (original) A space-time convolution filter designed according to the method of claim 1.
- 54. (original) A scanner for radiography having a filter according to claim 53.
- 55. (cancelled)

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56. (previously presented) A computer program product comprising a computer readable medium having computer readable program code means stored in the medium, the computer program product comprising:

a. computer readable program code means stored in the medium for causing a computer to provide for each pixel having coordinates (x,y) of a first image, a weighting is performed on coefficients $U(k,l)$ of a first convolution core with a dimension D, equivalent to a low-pass filter, as a function of a coefficient G which is a function of a difference computed between $I(x,y)$ and $I(x+k, y+l)$, where $I(x,y)$ is an intensity of the pixel with coordinates (x,y) of the first image, and k and l are indices used to explore the coefficients of the first convolution core, a second convolution core with coefficients $Up(k,l)$ being thus obtained;

b. computer readable program code means stored in the medium for causing a computer to provide for each pixel with coordinates (x,y) of the first image, a weighting is performed on the coefficients $U(k,l)$ of the first convolution core as a function of the coefficient G which is a function of the difference computed between $I(x,y)$ and $I'(x+k, y+l)$, where $I'(x,y)$ is an intensity of the pixel with coordinates (x,y) of a second image, a third convolution core with coefficients $Up'(k,l)$ being thus obtained; and

c. computer readable program code means stored in the medium for causing a computer to provide a filtered value of $I(x,y)$ is computed by the formula:

$$F(x, y) = \left(\sum_{k=-L}^L \sum_{l=-L}^L (\gamma * Up(k, l) * I(x+k, y+l) + (1-\gamma) * Up'(k, l) * I'(x+k, y+l)) \right) / N \dots (1)$$

$$L = (D-1)/2 \dots (2)$$

$$\gamma \in [0,1] \dots (3)$$

$$N = \sum_{k=-L}^L \sum_{l=-L}^L (\gamma * Up(k, l) + (1-\gamma) * Up'(k, l)) \dots (4)$$

where $F(x,y)$ is the filtered value of $I(x,y)$; and

wherein D is greater than 1;

wherein a value of γ is greater than 0 and less than 1.

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57. (previously presented) An article of manufacture for use with a computer system, the article of manufacture comprising a computer readable medium having computer readable program code means stored in the medium, the program code means comprising:

a. computer readable program code means stored in the medium for causing a computer to provide for each pixel having coordinates (x,y) of a first image, a weighting is performed on coefficients $U(k,l)$ of a first convolution core with a dimension D, equivalent to a low-pass filter, as a function of a coefficient G which is a function of a difference computed between $I(x,y)$ and $I(x+k, y+l)$, where $I(x,y)$ is an intensity of the pixel with coordinates (x,y) of the first image, and k and l are indices used to explore the coefficients of the first convolution core, a second convolution core with coefficients $U_p(k,l)$ being thus obtained;

b. computer readable program code means stored in the medium for causing a computer to provide for each pixel with coordinates (x,y) of the first image, a weighting is performed on the coefficients $U(k,l)$ of the first convolution core as a function of the coefficient G which is a function of the difference computed between $I(x,y)$ and $I'(x+k, y+l)$, where $I'(x,y)$ is an intensity of the pixel with coordinates (x,y) of a second image, a third convolution core with coefficients $U_p'(k,l)$ being thus obtained; and

c. computer readable program code means stored in the medium for causing a computer to provide a filtered value of $I(x,y)$ is computed by the formula:

$$F(x, y) = \left(\sum_{k=-L}^L \sum_{l=-L}^L (\gamma * U_p(k, l) I(x+k, y+l) + (1-\gamma) * U_p'(k, l) I'(x+k, y+l)) \right) / N \dots (1)$$

$$L = (D-1)/2 \dots (2)$$

$$\gamma \in [0,1] \dots (3)$$

$$N = \sum_{k=-L}^L \sum_{l=-L}^L (\gamma * U_p(k, l) + (1-\gamma) * U_p'(k, l)) \dots (4)$$

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where $F(x,y)$ is the filtered value of $I(x,y)$; and
wherein D is greater than 1;
wherein a value of γ is greater than 0 and less than 1.

58-60. (canceled)